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Crayfish

Prepared in the Division of Fishery Biology

Teachers of zoology use the term "crayfish," but "crawfish" is the more popular name in America. In some regions, this animal is incorrectly referred to as a "crab." The terms "crayfish," "crawfish," and "crab" come from the old German word "Krebs," from which are derived the German "Krebs", and its English equivalent "crab," the French word "ecrevisse" and the English equivalent "crayfish."

In the United States these crustaceans are comprised of two genera, Cambarus and Astacus, the former being peculiar to the eastern states and Canada; the latter, which also occurs in Europe, is restricted to the Pacific slope of this country.

Life History and Habits

In Cambarus mating usually occurs during the fall, although under certain conditions it may take place in winter or spring. The male throws the female on her back and deposits the spermatozoa on the under side of her body about the external openings of the oviducts. Some of the females lay their eggs in the fall; some the following spring; the eggs are fertilized as they pass over the sperm, which has been placed as just stated. As the eggs leave the oviducts each one is covered with a viscous material which becomes drawn out into a fine thread by which the egg becomes attached to the swimmerets on the under side of the abdomen or tail. From 200 to 400 eggs are laid at one time, and these hatch within about eight weeks; the young remain attached to the swimmerets for a few days.

The crayfish grows by molting or shedding its shell; this process takes place very frequently with the young during the first year, and the period after each molt is said to be a critical time in the life of the animal, as it is then in a soft state and relatively helpless against enemies. When about four months old the young average about 1-1/2 inches in length. Females one year of age, about three inches long, have been found carrying eggs upon the abdomen. So far as the Fish and Wildlife Service is aware no successful artificial method of preparing soft shell crayfish has been devised. The soft shell in crabs and other crustaceans is not a permanent condition, but occurs periodically as a result of growth; the old shell is shed when a certain increase in size is attained, after which the animal appears with a new and larger shell that remains soft for a few days and soon hardens.

Crayfish have a pronounced sense of touch, especially on the claws and mouth parts. The organs of vision are two compound eyes which enable the animal to respond to the stimulus of large moving objects; they are sensitive to strong light and hide during the day. The senses of taste and smell are located on the antennae and mouth parts, but the best evidence available indicates that the sense of hearing is lacking.

Crayfish are omnivorous, eating fresh or stale animal and vegetable food, such as insect larvæ, mussels, leeches, fish, frog and toad eggs, worms, dead leaves, corn, and nearly any sort of garden vegetable and parasites.

They have several enemies, including, besides bacteria, many fish, salamanders, snakes, turtles, kingfishers, and man.

Extermination

Some kinds of crayfish make extended burrows, which may terminate at some distance from the pond or stream in openings at the surface of the ground surrounded by built-up circular walls of mud, known as "crayfish chimneys." Where crayfish of burrowing habits are excessively numerous, they accomplish much damage to gardens or farm lands. The following methods of exterminating crayfish in fields have been recommended by the U. S. Department of Agriculture in Year Book Separate 571, 1911:

Obtain chloride of lime at the drugstore and dissolve it in water at the rate of one pound to three gallons of water. Put some of this solution in a sprinkling-pot with the sprinkler removed, leaving only the bare nozzle. Pour about a tablespoonful of the liquid down each crayfish burrow and securely close the opening at once by pressing the earth together with the foot. The chloride of lime will kill the crayfish in a few hours.

Two or three drops of carbon bisulphide, applied in the same way, is effective, but this substance is more expensive than the chloride of lime.

Under date of September 27, 1919, the Barrett Company, 17 Battery Place, New York, suggested the use of a coal tar distillate, known as Carbon-Bisulphide-Benzol. They state: "In the distillation of coal tar, a low boiling fraction is recovered consisting of a mixture of Benzol and Carbon-Bisulphide; this is known as Carbon-Bisulphide-Benzol, and the quantity available over the country is large; so far, however, no extensive uses for this material have been developed."

The price of Carbon-Bisulphide-Benzol would be less than one-half that of the straight Carbon-Bisulphide.

It is not yet known whether this compound would be effective in destroying crayfish, and that could be determined only by experiment.

The Industry

Formerly, only one species, Astacus nigrescens, appears to have been used to any extent as food, and this largely in San Francisco. This probably resulted from the fact that it was the only species found in the vicinity of the city, outside of which there was at that time little or no demand for that sort of food. The san Francisco supply was largely

obtained from Coyote Creek, Santa Clara County, and from sloughs of the San Joaquin River.

Later the only considerable fishery for crayfish developed in Oregon, where in 1904 Portland was reported to be the center of practically all the crayfish business on the Pacific Coast, whence the crayfish were sent to Seattle, Tacoma, San Francisco, Salt Lake City, Butte, and even as far east as St. Louis. The species principally caught is Astacus leninuscus, which is the largest of the species in Oregon. It seems to attain its perfection of size and flavor in certain Columbia River waters, although it occurs elsewhere. Astacus nigrescens also occurs in the same region, but comparatively few of this species are used, these being marketed mainly in San Francisco. In Oregon the principal fisheries are stated to be in the Tualatin, Yamhill, Willamette, and Columbia Rivers. The Columbia River slough are said to furnish the chief supply, and in them as early as 1904 more than 50,000 dozen were reported to have been taken annually. The United States Bureau of the Census, in its Report on the Fisheries of the United States in 1908, gives Oregon as the only state of the Pacific Coast supporting a crayfish fishery, and the catch for that State as 178,000 pounds, valued at \$14,000. In 1936 in Oregon the catch was 86,900 pounds valued at \$9,559, and this was the only catch of fresh-water crayfish reported for the Pacific Coast.

In Louisiana, according to the U. S. Census Report for 1908, there were taken 88,000 pounds, valued at \$3,600. The Fish and Wildlife Service has no further figures regarding this industry for the Atlantic Coast, but it is known that New Orleans and New York are the principal centers of consumption for crayfish.

In the State of Wisconsin, in 1937 there were taken from Lake Michigan 41,500 pounds, valued at \$4,150.

In the fishery for crayfish, various types of nets are used; some are taken with lines and a very few with seines.

Since crayfish mature in one year and reach a length of four or five inches in three years, and since 200 to 400 eggs are laid by one female, it would seem that a large demand could be supplied. There should be no difficulty in disposing of the smaller species, Cambarus, either as fresh food or canned, in a manner similar to the way shrimps are marketed.

Culture

The Fish and Wildlife Service has conducted no experiments in crayfish culture. The species of most economic value are those which are found in rivers, living under conditions which are not favorable to cultural operations. Crayfish occur mostly in sluggish waters from 6 to 26 feet or more in depth, but some species are found in swift rocky streams. Certain species

grow readily in ponds and are liable to become a nuisance through the destruction of the embankments. Not all species of crayfishes have the burrowing habit, but those which do burrow may be injurious to dams and levees, whether they live in ponds or rivers.

On the other hand crayfishes form an important article of food for carnivorous fishes, especially for the large and small-mouth black basses, some sunfishes, the yellow perch, catfishes, and bowfish. They also are used as food for man, and in that connection furnish the basis for a fairly large industry, which is discussed above. In considering, however, the possible benefits to be derived from the introduction of crayfish into new waters, attention must be paid to the possible damages which they may accomplish by their burrowing habits.

Culture in Europe

Astacus fluviatilis is the common crayfish of Europe. In the Report of the United States Bureau of Fisheries for 1879, pp. 767-770, is an article on crayfish culture in Europe, translated from the German. The Report may be consulted in various public libraries receiving the publications of this Service.

Following is a brief account of the crayfish and its culture in France, by M. Elwartt, translated from the Bulletin de la Societe Centrale d'Aquiculture de France, pour l'annee 1890, Vol. 11, pp. 93-95:

The placing of crayfish in waters which it is proposed to restock demands certain care, which Dr. Behrends has discussed in a recent article.

The first precaution to be observed is, at the beginning of operations, to plant only females; the males have a disposition to devour the young and would destroy too many of them. It is important, therefore, to know how to distinguish the males from the females. The latter have the tail, or to speak more exactly, the abdomen, much wider, especially in the middle; the pinchers are smaller than in the males, which with these offensive and defensive weapons, often engage in murderous combat. But the most apparent distinctive character in the males is four recurved stylets, almost white in color, attached to the under surface of the first two segments of the tail; and turned forward between the posterior swimmerets to the under surface of the body. In the females there are only soft filaments in place of the first pair of these stylets.

It is generally from the end of September to the beginning of November that mating takes place; the eggs are produced from December to January.

On coming from the oviduct the egg is covered by a viscous material which extends into a short filament or thread, the extremity of which attaches to one of the long hairs fringing the swimmerets. This viscous material hardens rapidly and the egg remains attached to the hair of the swimmeret by a sort of stem or peduncle. As it shares all the movements of the swimmeret the egg is constantly agitated in the water and kept aerated and clean while the young is developing within.

In June and July the eggs hatch, but the young remain clinging to the swimmerets of the mother, and carried in the shelter of her abdomen, as in a sort of chamber of incubation, for about 10 days. During this period the young effect their first moult, or change the carapace for the first time.

The month of May (in France) is the most favorable time for releasing crayfishes destined for the restocking of waters, since the females are then laden with eggs ready to hatch, and the resulting young easily acclimate themselves in the waters in which they are born. The number of eggs produced by an individual varies from 100 to 200, according to the age of the animal and the amount of food taken.

For the reasons cited, it is only in September, when the season's young have attained a certain development, that the males should be introduced into the waters with the females in order to assure fertilization for the following season.

Whether it concerns males or females, the transportation of crayfishes should be made with the following precautions. First, never pack them wet, but allow them to become quite dry; second, place them in flat baskets lined with dry moss or straw and cover with weeds or straw. Packed with care they easily sustain a journey of two or three days.

The crayfish breathes by means of gills which are located beneath the carapace in a sort of cavity called the branchial chamber. When the animal is taken from the water it retains in this branchial chamber a sufficient supply of water to enable it to breathe for some time out of its natural element, for the bubbles of air which penetrate little by little under the carapace supply a sufficient amount of oxygen to the small quantity of water remaining in the branchial chamber. But these bubbles, which gather at the upper part of the respiratory organs, and which permit the animal to live out of water, can kill it if it is suddenly immersed. Compressed by the liquid, the air presses upon the gills and prevents them from functioning, causing the asphyziation of the crustacean. From this fact arises the absolute necessity of refraining from plunging these animals suddenly in water when it is desired to return them to this element.

It is best to place them upon screens, or in flat baskets near the edge of the water, and dampen them thoroughly by sprinkling with a watering pot with a sprinkling attachment, in order that they may slowly expel the air from their respiratory organs and refill them with water. They should be allowed to enter the water as they feel inclined.

The most favorable locations in which to release crayfishes are those parts of a stream where the current is moderate, with a depth of from 18 inches to six feet; the banks should be of a clayey or peatey character with vegetation, plenty of projecting roots, and numerous holes to serve as refuge for the animals.

Transported and introduced into the new waters with these few and simple precautions, crayfishes generally acclimate themselves readily and multiply in a satisfactory manner.

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